PLC 01
PROGRAMMABLE LOGIC CONTROLLER
PICK AND PLACE

Motivation

Programmable logic controllers, or PLCs, are ubiquitous in modern industry. Many, many processes are not continuous, hence not amenable to continuous control. These are processes needing switches to be turned on or off, condition flags to be set or unset and timers to be queried in fixed sequences. The PLC experiment is an example of widely used technology in which an electronic controller receives switch settings and opens and closes pneumatic valves. The valves, in turn, extend and retract pneumatic cylinders to accomplish a simple pick-and-place objective.

Before coming to lab, do the following:

(1) Read the attached notes.

(2) Construct a ladder-logic diagram that will query a start switch. When the start switch goes true, energize a solenoid connected to output 0. Then query the stop switch until it goes true and de-energize the solenoid.

In the lab before performing the experiment:

(3) In the Allen-Bradley MicroLogix 1000 User's Manual, read chapter 5 and the parts of chapter 7 that you anticipate needing.

Experiment

The first part is to be performed during the first afternoon session

(1) Implement you basic pneumatic-cylinder, on-off controller described in (2) above. Do this without air pressure being on. You can tell if a solenoid is energized by the green light being on.

(2) Add a timer to you basic controller so that the cylinder retracts in 5 seconds instead of when the off switch is pushed. If everything looks OK, try it with the air pressure on.

(3) Construct a ladder-logic diagram for the main task to be performed, and that is the picking of one-inch cubes from the rotary table in the order ___, ___, ___, ___, and ___, and placing them on the adjacent tray. The stop switch must be able to interrupt the process at any point. A block should be placed on the tray every ten seconds, not sooner, not later.

During the second laboratory afternoon, demonstrate your design.

Instructions for the introductory exercise

P000	ld		I/1	Query the on switch
	or		B/2	B2 is the continue bit
	set		B/0	If rung is true set the next rung enable bit
	rst		B/1	If rung is true set bit B1 to off (the wait-for-the-timer bit)
P001	ld		B/0	Is rung 0 completed?
	ton		T/0	If B0 is set start timer 0
	pre	100		
	acc	066		
	ld		T0/DN	load the timer-finished bit
	set		O/0	Activate cylinder 0
	set		B/1	Turn B1 on which says timer timed out
	rst		B/2	Not ready to continue to rung 3
P002	ld		B/1	B1 is the unactivate cylinder bit
	ton		T/1	If B1 is set start timer 1
	pre	100		
	acc	066		
	ld		T1/DN	load timer-finished bit
	rst		O/0	Deactivate cylinder 0
	set		B/2	Set the ready-to-continue bit
P003	ldi		I/0	Query the off switch
	rst	B/0		
	rst	B/1		
	rst	B/2		